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History of the Army Digitization Office

Susan J. Wright

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Susan J. Wright

PREFACE

This document was prepared by the Institute for Defense Analyses by the Simulation Center and Operational Evaluation Division for the Director, Operational Test and Evaluation, in partial fulfillment of the task "Battlefield Digitization." DOTE oversight of Army Battlefield Digitization is now in its fifth year. As the program progresses and evolves, it is important to understand how the Army has managed the program and what actions and activities have shaped it over the years. This document covers one aspect of Army Battlefield Digitization—the Army Digitization Office.

ACKNOWLEDGMENTS

I had the privilege of being a part of the Army Digitization Office (ADO) from its beginning in 1994 until my departure in 1999. The ADO has had many truly dedicated people pass through its doors over the years, many of whom were kind enough to support me on the development of this paper. I would like to thank the following individuals who participated in interviews and provided needed information to fill in the blanks: Mr. Stanley Levine, COL Wilton Ham, Mr. Robert Morig, LTC Hosie Pennington, Ms. Mary Thompson, Mr. David Jackman, Mr. Lawrence Walters, Mr. Ronald Cross, Mr. Steven Reaves, Mr. Stephan Gates, LTC Teddy Cranford, Mr. Gene Summerlin, Mr. Roy Maday, Mr. Chris Leins, COL (Ret) Christopher Fornecker, and Ms. Renee Stevens.

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HISTORY OF THE ARMY DIGITIZATION OFFICE

The Army Digitization Office (ADO) Charter was formally signed on 9 June 1994, and the ADO was designated as a staff agent for both the Army Vice Chief of Staff (VCSA) and the Army Acquisition Executive (AAE). Establishing the ADO was the culmination of a year's worth of studies and special task force reports. The main purpose of the ADO was to oversee and coordinate the integration of Army battlefield digitization activities, including the areas of programmatics, technological implementation, and doctrine.

A. THE IMPETUS BEHIND THE FORMATION OF THE ADO

Following the fall of the Berlin Wall in 1989, Congress put pressure on the Department of Defense to downsize. The pressure became real as the budgets were slashed and the drawdown of forces began.

After the Gulf War ended in 1991, the pressure to downsize continued. Research and development and procurement budgets continued to absorb cuts. At the same time, in places like Somalia and Bosnia, the Armed Forces were used more frequently against nontraditional threats. It became clear to senior leaders that the makeup of the Army would have to evolve to meet the smaller budgets and changing threats.

General Gordon Sullivan, the then Army Chief of Staff (CSA) states in his book, *Hope Is Not a Method*:[1]

> We postulated that the nation needed a versatile force that, although smaller, would be effective in a broad range of missions. Information would be the new source of power, not only in combat but in all our operations, with a shared situational awareness creating an environment in which our units could operate much faster and much more effectively than any adversary. (p. 8)
>
> We were beginning to understand that the tools of war were changing dramatically. Information was becoming the critical component of our weapons; sensing, communicating, and data-handling technologies were

---

1 *Hope Is Not a Method*, Gordon R. Sullivan and Michael V. Harper, Random House, 1996.

> rapidly reaching the point that we could truly make the battlefield transparent and focus our capabilities as never before. (p. 41)

The bureaucracy that supports the planning and budget functions in the Department of Defense is not able to handle incremental changes brought about by a spiral development process used to determine technology requirements. It is designed so individual programs are reviewed and funded separately. There is little impetus to integrate across programs, and in many ways it is detrimental to do so. Yet the desire to organize a "new" Army around information is going to require significant and immediate changes in the way programs are developed and funded, as integration and interoperability become the keys to making the information-based Army function. As the Army conducts experiments, requirement changes emerge. In the area of information technologies, a significant improvement in capability occurs within an 18-month cycle, yet the planning, programming, and budgeting system (PPBS) process will take at least 2 years before funding can be applied on the previous technology. This places the Army, and all the Services, at an extreme disadvantage in acquiring the latest in technology. The PPBS process needs to become more responsive to this spiral improvement in technology development.

In 1993, the Office of the Deputy Chief of Staff for Operations (ODCSOPS) released a memorandum, "Horizontal Technology Integration (HTI) Concept Paper," that outlined an aggressive approach to modernizing existing systems. This approach mandated the development of system requirements that would integrate systems and capabilities across multiple programs and mission areas. The goal was to field common and interoperable technologies through new acquisitions, product improvements, or system upgrades. One area identified in the memorandum was the exploitation of communications and information technologies—digitization.[2]

A special task force (STF) was formed in November 1993 to outline the platforms, equipment, and processes necessary for the Army's digitization effort. The STF concluded it was essential that equipment, standards, formats and protocols, and naming/addressing schemes enable system-to-system and processor-to-processor linkages across the battlefield. It recommended that digitization be intensely managed to ensure these requirements were enforced.

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2 Charter for the Army Digitization Office, 9 June 1994.

Based on the recommendations, the CSA directed that a second Digitization STF be chartered to accomplish the following:

- Prepare draft operational requirements,
- Prepare a draft technology assessment and architecture,
- Perform a trade-off analyses,
- Draft an acquisition strategy/plan and provide a funding estimate,
- Draft and coordinate an Army Digitization Office charter.[3]

As a result of the second STF report, the CSA set forth the following goals: a digitized Brigade by 1996, a digitized Division by 1997, and a digitized Corps by 1999. The overall challenge to digitize the force was to move fast; spend little money; expect growth; accept that change would be needed; and integrate across platforms, systems, and battle operating system (BOS) boundaries.

The ADO Charter was signed on 9 June 1994, the office formally established in July 1994.

B. FORCE XXI

The CSA codified his concepts for a future force and entitled the effort Force XXI.[4] This concept would evolve the Army into a new force based on information superiority. Force XXI would control the power of information and technology and incorporate unprecedented battle command capabilities to ensure a more lethal, more mobile, and more survivable fighting force.[5] The modernization process was to proceed simultaneously along three axes:

- Main effort—Redesign the operating force—led by the Training and Doctrine Command (TRADOC).
- Supporting effort—Provide the digital enablers, introduce modern information technologies to the battlefield—led by the VCSA and AAE and coordinated by the ADO.
- Supporting effort—Restructure the TDA (Table of Distribution and Allowances) and institutional Army—led by the VCSA with the Major Commands and executed by DCSOPS.

---

3 Special Task Force Final Report, July 1994, p. 1-1.

4 Chief of Staff, Army, letter, 8 March 1994, Subject: Force XXI.

5 HQDA, Force XXI Campaign Plan.

Over the next 4 years, this division of responsibilities proved unfortunate because it created an environment for conflicts centered on who was actually in charge of digitizing the force.

The central effort was designated *Joint Venture* and provided a framework to assess operational capabilities. Its goal was to determine how the Army would fight in the 21st century, while guiding development of doctrine, training, leader development, organizations, material, and soldiers (DTLOMS). Joint Venture served as the basis to develop the capability of Army forces to conduct successful operations under joint command employing modern, knowledge-based warfare. In addition, it was to examine tactics, techniques, and procedures and technology alternatives that enhance the lethality, survivability, and battle command capabilities of the operating forces.

C. THE 1994 ADO CHARTER

The STF recognized that the integration functions that had to take place within the Army to effect the goals of the CSA crossed all functions of the Army staff, from combat developments, to training, to research and development, to programming and budget. As such, the ADO was chartered to work for two elements—the Vice Chief of Staff of the Army and the Army Acquisition Executive.

Specifically the Charter outlined the mission and scope of the ADO:

> ...to oversee and coordinate the integration of Army battlefield digitization activities. Within the Headquarters of the Department of the Army (HQDA), the ADO functions as a staff element of the Army Acquisition Executive (AAE) and the Vice Chief of Staff (VCSA). The ADO is the VCSA's instrument for digitization activities across the major commands. Likewise, the ADO is the AAE's instrument for providing guidance, assistance and coordination in acquisition matters related to digitization.
>
> The ADO is specifically charged with advising the AAE and VCSA on all matters concerning the integration of digital capabilities across the force and overseeing the integration of Army digitization activities consistent with the AAE's and CSA's vision.
>
> In addition, the ADO has the responsibility of monitoring and assisting in the coordination of Army, Joint, governmental (e.g., Commerce) and Allied activities impacting on, or by, Army battlefield digitization.

The ADO advocates and supports streamlined acquisition strategies to develop, assess, procure and field equipment in support of the aggressive acquisition timelines implicit in the CSA's guidance.*

The original span of control diagram shown in Figure 1 was designed to support the wide-ranging functions and tasks assigned to the ADO:

- Develop and maintain a digitization master plan.
- Oversee and coordinate the implementation of the AAE's and VCSA's approved digitization master plan.
- Assist in defining, developing, coordinating, or determining the following:
  - Detailed operational, interoperability, and standardization requirements (including doctrine, training, organizations, and leader development).
  - Technology assessments, best technical approach and trade-off analyses.
  - Development and evolution of a common architecture and standards, formats, and protocols.
  - Interface requirements between elements of the architecture.
  - Synchronization of and providing resources for modeling, simulation, experimentation, demonstrations, testing, and evaluations in digitization.
  - Value added to the Force and, given the results of equipment developments and experimentation, evaluation of new organizational designs.
- Recommend, maintain, and update planned digitization program funding by use of the digitization management decision package (MDEP).

The Charter was to be reviewed after 5 years. The ambitious schedule set forth by the CSA to digitize a corps by 1999 led to the belief that a special organization like the ADO would not be needed once this task had been accomplished. By the time a corps had been fielded, the means to field the rest of the Army would become embedded in the existing bureaucratic structures and processes.

D. ORGANIZATIONAL STRUCTURE

It was clear from the Charter that the ADO would have to be involved in every aspect of program definition, development, and execution. As such, the STF designed an organization that drew expertise from throughout the Department of the Army.

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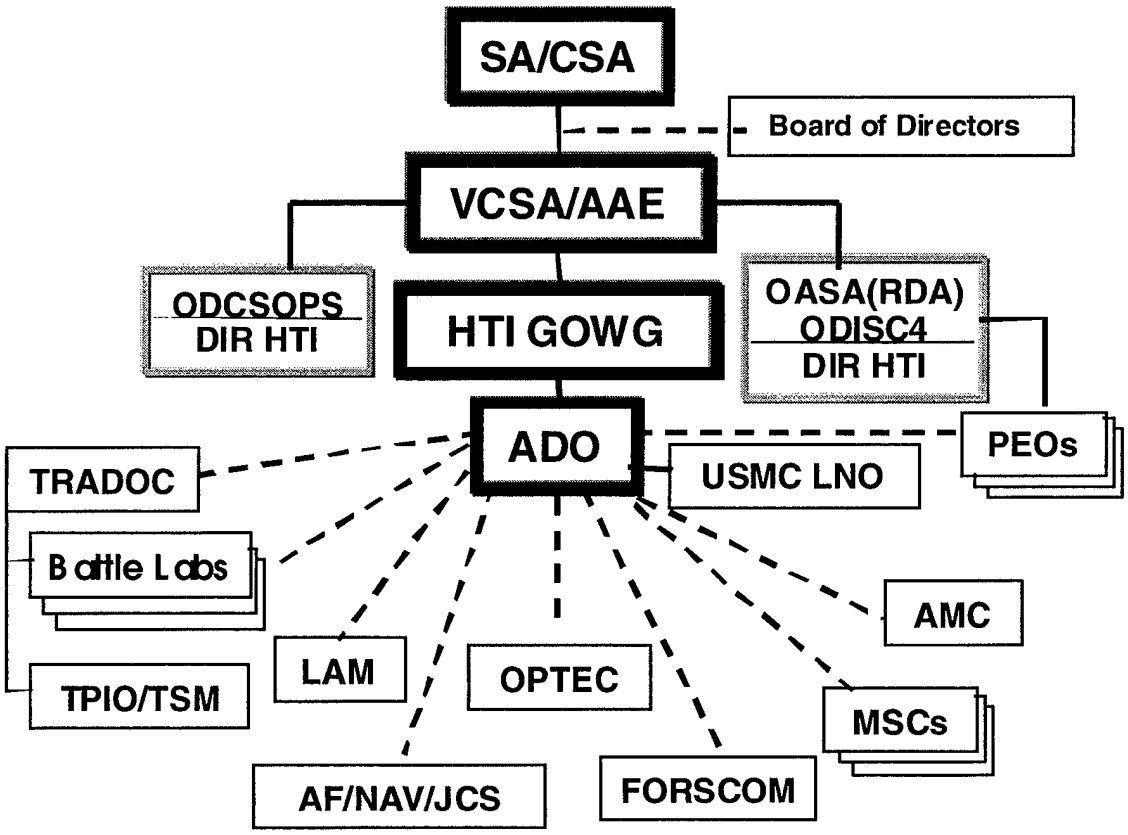
* See Note 3.



AAE - Army Acquisition Executive

ADO - Army Digitization Office

AF - United States Air Force

AMC - Army Materiel Command

CSA - Chief of Staff Army

Dir HTI - Director, Horizontal Technology Integration

FORSCOM - US Army Forces Command

HTI GOWG - Horizontal Technology Integration General Officer Working Group

JCS - Joint Chiefs of Staff

LAM - Louisiana Maneuver's Task Force

MSC - Major Subordinate Command

NAV - US Navy

_____ - Reporting Chain

OASA(RDA) - Office of the Assistant Secretary of the Army, Research Development and Aquisition

ODCSOPS - Office of the Deputy Chief of Staff for Operations

ODISC4 - Office of the Director Information Systems, Command, Control, Communications, and Computers

OPTEC - US Army Operational Test and Evaluation Command

PEO - Program Executive Officer

SA - Secretary of the Army

TPIO - TRADOC Program Integration Office

TRADOC - US Army Training and Doctrine Command

TSM - TRADOC System Manager

VCSA - Vice Chief of Staff, Army

-------- - Coordinating Activites

Figure 1. Scope of ADO Interactions—1994 Charter

To ensure a level of credibility, the ADO was commanded by a senior two-star general, with a civilian deputy from the Senior Executive Service (SES). The organization was divided into four areas: requirements and evaluation, architecture, acquisition, and integration. Twenty-five government slots were authorized (10 military and 15 civilians). Figure 2 shows the initial structure and staffing plan.

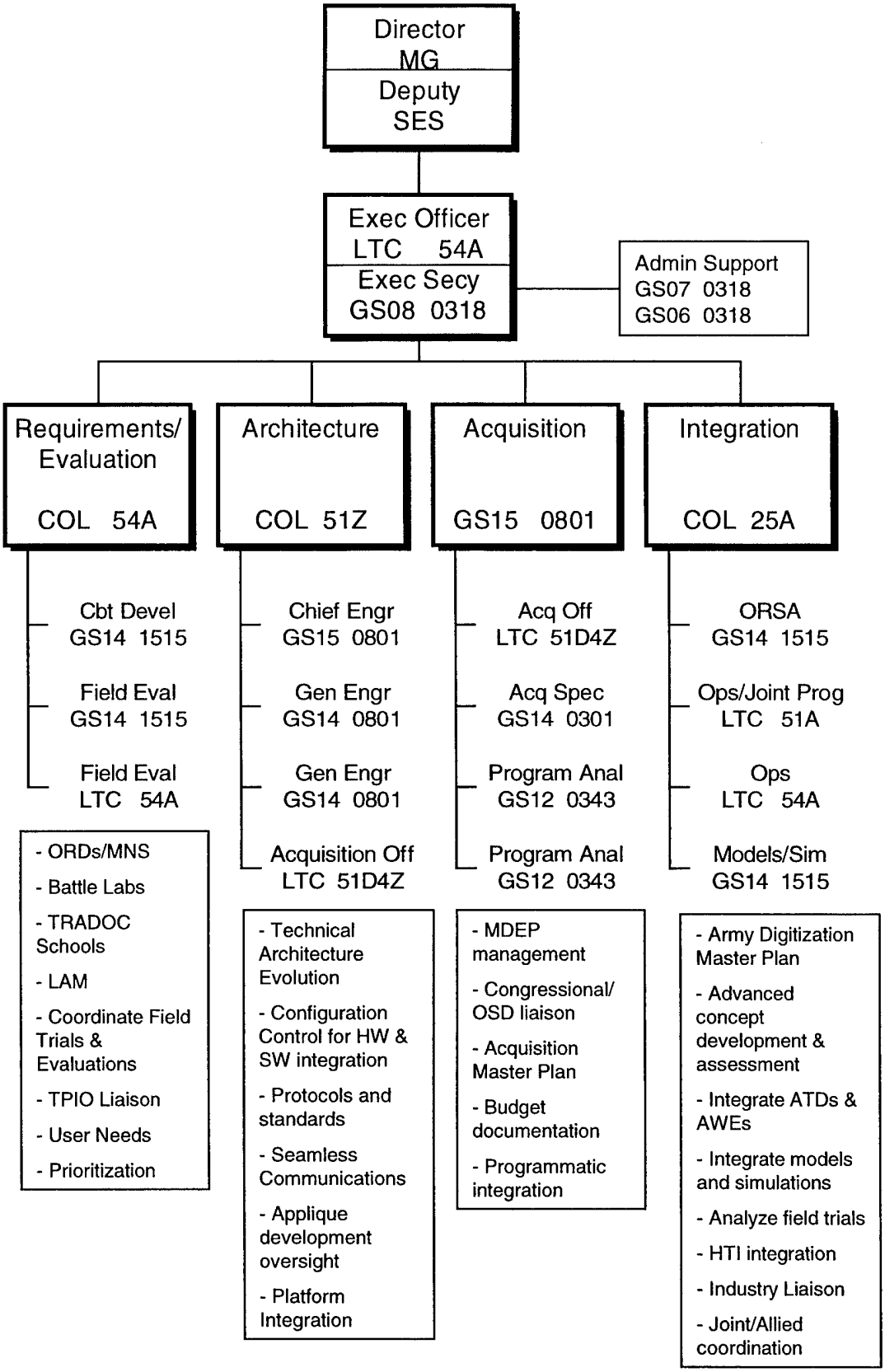


Figure 2. ADO Organizational Structure—1994

The civilian slots were provided by the AAE and controlled by the Army Acquisition Executive Support Agency (AAESA), a relationship that continues today. Seven personnel from the STF stayed on with the new ADO; the remaining personnel were recruited by normal military and civilian personnel channels. On 8 July 1994 the first director of the ADO, MG Joe W. Rigby, reported for duty. By September a majority of the slots had been filled, and the ADO began its unique mission to digitize the force.

E. THE DRIVING FACTOR

The Army's Force XXI concept relied heavily on the notion that live experimentation was the best way to allow the leadership to look at the synergy of new warfighting concepts, new force structures, and advanced technologies. These experiments—Advanced Warfighting Experiments (AWEs), as they were tagged—were the primary means selected by TRADOC to redesign the operational Army. The AWEs were under the direction of TRADOC. Between 1994 and 1997 the Army conducted three major AWEs, one with a heavy battalion (Focus Dispatch), one with a light unit (Warrior Focus), and the culminating brigade AWE (Task Force XXI). The AWEs, by definition, relied heavily on the infusion of information technologies, technologies that were yet to be developed. To meet the goal of a brigade level AWE in 1996, the ADO focused a majority of their effort on getting a brigade-level command and control system to the experimental force. Over the next 3 years the Brigade AWE was the driving factor for all actions within the ADO.

F. EARLY ACCOMPLISHMENTS 1994–1996

The ADO built on the foundation begun by the STF and focused on the tasking in its charter to develop a Digitization Master Plan for the Army. As a result, the Army Digitization Master Plan (ADMP) was signed and published on 30 January 1995. The ADMP outlined the Digitization Campaign Plan that would get the Army to the Brigade AWE. During these early years, ADO personnel usually described their duties as follows: "The ADO doesn't really do anything itself; our job is to make sure everyone else is doing their job." Appendix A is a chronology of key events from 1993 through 1999.

1. Architecture Team

The ADMP codified the requirement to develop technical, system, and operational architectures as the foundation for the digital battlefield. The operational architecture says what to build, the system architecture says how to build it, and the

technical architecture states the rules and standards to follow. A study by the Army Science Board,[6] as well as the work of the STF showed that the envisioned interoperability could only be achieved by the application of agreed upon standards and protocols across all systems that process information. In addition, to allow the Army to capitalize on the rapid changes and advances in information technology, the standards and protocols were to mirror those found in the commercial world.

The Architecture Team worked with Office of the Director, Information Systems, Command, Control, Communications, and Computers (ODISC4); Program Executive Office Command Control Systems (PEO CCS); Communications and Electronics Command (CECOM); U.S. Army Signal Center; and many others to develop the architectures.

In March 1995 the first approved Department of the Army C4I Technical Architecture (ATA) was released for implementation under a cover letter signed by the AAE.[7] Subsequent versions continued to build on the foundation of this initial version, and in June 1996 the VCSA announced that the Department of Defense had adopted the ATA as the basis for the Joint Technical Architecture.[8]

In 2 years, through the persistence of the ADO Architecture Team, the Army and Department of Defense went from no consistent standards and system-unique protocols to a set of standards and protocols based on commercial standards that would be applied Department wide. The next challenge was to implement those standards within existing programs.

The AAE memorandum required each Army Program Manager or Milestone Decision Authority to comply with the technical architecture and tasked the ADO to oversee and coordinate the implementation of the ATA in all digitization efforts. Implementation plans (which became known as migration plans) that identified cost, schedule, and performance impacts were to be provided the ADO. The Architecture team set up a process and formats, but saw little participation by program managers.

In June 1996, the VCSA sent a message announcing that the ATA was an important step in moving toward the Army's ultimate objective of providing the warfighter a

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6 Army Science Board Summer Study: "Technical Architecture for Army C4I," 1994.

7 Memorandum, OASA(RDA), 31 March 1995, Subject: Implementation of the C4I Technical Architecture.

8 Message, VCSA, DACS-ZB, 061905Z Jun 96, Subject: Army Technical Architecture Implementation.

seamless flow of timely, accurate, accessible, and secure information. Acceptance of the ATA across the Department of Defense set the stage for inter-Service interoperability, not just Army interoperability. The VCSA noted, however, that until all Army systems migrated to the new standards, this objective would not be met. He established FY2006 as the deadline for all systems to become compliant. Further, the VCSA made compliance a higher priority than individual system capability, agreeing to trade-offs in the Program Objective Memorandum (POM) to make it a reality. The ADO was again named as the agent responsible for migration plans. Over the next year, the ADO, in conjunction with DISC4, reviewed and approved plans for every information-based system in the Army. The impacts are still being felt today as programs struggle with the trade-off of compliance over capability.

The concepts outlined in the technical architecture were new to the operational world, and the architecture team spent time educating the senior leadership on the importance of key elements in the architecture and the requirements for interoperability and system integration. It was crucial to have the buy-in and understanding of the operational community to ensure that the technical architecture ideas were incorporated into emerging C4I requirements.

As stated previously, the focus of the ADO was getting the brigade-level command-and-control capability for the Task Force XXI AWE. With the technical architecture approved in 1995, the next step was to develop the hardware and software system to support the experiment. The Architecture Team was a critical player in developing the original request for proposal and in evaluating and selecting subsequent bidders. Building on the recommendations of the STF, the Architecture Team worked closely with PEO CCS to (1) develop and assess the technology trade-offs for the applique,[9] (2) establish the concept and design of the tactical internet, and (3) establish the overall architecture for the experiment. They reviewed modeling results, system architecture details, and ensured adequate system integration and testing was performed before equipment was given to the experimentation force.

The Architecture Team also worked with the Signal Center, PEO Communications, and CECOM to plan for the evolution of future battlefield communications capabilities to a wideband, multimode network.

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9 The term "applique" was used in these initial phases of the FBCB2 development because the hardware and software would not be integrated into a platform. The hardware was simply mounted, or appliqued, onto platforms for the purpose of experimenting with new warfighting concepts and developing user requirements for the future integrated system.

2. Acquisition Team

The Acquisition Team was responsible for resource management, acquisition planning oversight, and streamlining the acquisition process in support of the Force XXI digitization effort. During the early years of the ADO, the Acquisition Team functioned as a quasi program management office for the applique product development.

In November 1994, a memorandum from the Deputy Assistant Secretary for Plans, Programs and Policy, Army Systems Acquisition, outlined how the applique sets would be treated in the acquisition milestone review arena. Previous agreements between OSD and the Army permitted the applique to be treated as an Acquisition Category III (ACAT III) program because it was only being "procured" for experimentation purposes. To keep with this spirit, the memorandum delegated decision authority to PEO CCS and specified that "an additional program/project/product manager will not be assigned."[10] This lack of program structure left many of the standard acquisition functions up to the only organization that had people dedicated to the digitization program, the ADO.

The ADO Acquisition Team worked with elements of the PEO to develop the initial Digitization Acquisition Strategy that was approved by the AAE on 20 January 1995. This document guided the development of the applique through the Brigade AWE in 1997. The approach was phased based on specific events that were laid out:

- *Phase 1—FY94 through FY97.* The focus was on the development of experimental hardware, software, and architectures that would then be used to equip the experimental force for their train-up and execution of the Brigade Task Force XXI AWE. Three types of applique sets would be evaluated—commercial off-the-shelf, ruggedized, and near-military specification. Following the Brigade experiment, the best type of sets would be selected and a new solicitation would be released.
- *Phase 2—FY97–FY99.* Applique sets were to be improved based on the Brigade AWE experiences to provide a go-to-war capability. It was to end with the execution of a Corps XXI AWE (which as of this writing has not been scheduled).
- *Phase 3—FY00–?* The final Milestone III review would take place and a deployment award would be made for a full corps set of equipment. In addition, a full-scale deployment contract to equip the rest of the Army would be competitively awarded.

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[10] Memorandum, SARD–RP, 2 Nov 1994, Subject: Delegation of Milestone Decision, Authority for Digitization Applique Sets.

The Acquisition Team was also in charge of the funding needed to develop the applique. The ADO maintained and updated the planned digitization program funding through the MDEP for digitization. This MDEP was specifically developed based on recommendations of the STF in 1994. The Battlefield Digitization MDEP was to provide visibility for digitization efforts throughout the Army. At the same time, it was to permit better integration of all research, development, procurement, operations, and maintenance funding associated with digitization, as well as coordinate and track the efforts of individual PEOs to achieve an integrated digitized system.

The ADO was given direct control over all funds associated with the development and procurement of the applique, but only oversight over other program funds. The ADO tried several means to gain better insight into these oversight funds, but was not successful. Early on, PEOs were required to gain ADO signature for release of funds, but with no real authority to withhold funds, this quickly became unmanageable. Later, the Acquisition Team had the individual PEOs brief their programs to the Director of the ADO in an attempt to surface any problems or issues germane to the overall digitization of the Army. This also proved ineffective. PEOs were reluctant to air problems to "outsiders" or to show that they were not meeting integration or architecture requirements.

The development of the applique and the money needed to move that program forward proved a significant challenge and occupied a large part of the Acquisition Team's time early on. They were successful in outlining a program that would adequately meet the needs of the experiment. The constant changes in what was needed required a close working relationship with DCSOPS requirements division to find the funds to cover unexpected expenses.

The team also expended significant effort educating the Program Analysis and Evaluation offices at both OSD and the Army on what the Army's digitization effort was all about and the funding requirements to make it happen. They also worked closely with congressional committee staff members who were responsible for keeping the funding interest alive at the congressional level. The ADO was the Army's primary spokesman for digitization.

3. Requirements/Evaluation Team

The Requirements and Evaluation Team was the ADO's interface with the user and test communities: TRADOC; Operational Test and Evaluation Command (OPTEC); the Experimental Force (EXFOR) at Fort Hood, Texas; the Army Staff; and other Defense agencies that dealt with operator issues. The team was responsible for supporting

the TRADOC Joint Venture axis of the Army's Force XXI Campaign Plan, the organizational restructuring of the force.

The team worked on many tasks between 1994 and the Brigade AWE. The two primary areas included development of experimentation and evaluation plans and the deployment of the appliques to the experimentation force at Fort Hood. Additional areas of effort included the review of mission need statements (MNS) and operational requirements documents (ORD) associated with digital equipment and the integration of digitization in models and simulations.

The Experimentation Master Plan (EXMP) was developed by the Applique Office under the guidance of the ADO. It mirrored in many ways a typical Test and Evaluation Master Plan (TEMP) and was used to add some discipline to the experimentation process that was to end with a milestone decision regarding the applique. An experimentation integration working group consisting of representatives from PEO CCS, ADO, CECOM, TRADOC, OPTEC, and the Army Material Systems Analysis Activity (AMSAA) was formed. The EXMP laid out a set of operational and technical performance objectives to be benchmarks for the experiment from an acquisition perspective. Development of the EXMP was successful at bringing the key system evaluation agencies together early in the program and identifying a logical series of experiments and tests that would help mature the applique. These same agencies would be responsible for the assessment of system performance during the AWE, as well as when the applique transitioned to an acquisition program following the AWE. The EXMP applied several streamlining concepts: integration of the operational test community early in the system development and design process, identification and use of contractor testing to meet government data needs, and government participation in contractor testing.

During this same period, the Director, Operational Test and Evaluation (DOTE), at OSD added Army battlefield digitization to his oversight list. The Requirements and Evaluation Team worked with DOTE to develop an oversight concept that recognized the experimental nature of digitization, while addressing the transition to acquisition. This concept was the first of its kind for an organization that normally assesses individual systems. Battlefield digitization was a system-of-systems concept, and it would require a new way of doing business. The agreement, signed by Director, OTE, in September 1995

allowed the Army to continue its experimentation efforts and had DOTE partnering with OPTEC to operationally assess and evaluate the Force XXI AWEs.[11]

When the acquisition community was putting together its experimentation plans, the user community (TRADOC) was putting together its concept for evaluation of the AWE. The ADO was an integral part of this process and worked across all the analytic agencies to ensure that a credible evaluation of digitization would be available at the end of the AWE.

On the requirements side, the team was key in establishing the user jury process that permitted TRADOC to influence the development of the applique hardware and software and establish priorities for messages and other system capabilities. The user jury was able to review prototype software from the developer and became the initial step in the applique's spiral development process.

The Digital Integration Lab (DIL) was established at CECOM to ensure the various digital systems that were part of the Brigade AWE would be interoperable and able to pass message traffic to each other. The Requirements Team was responsible for establishing the guidelines associated with the DIL, monitoring the progress of inter-operability testing, and certifying that systems were ready for the AWE. The DIL was later supplanted by the development of the Central Technical Support Facility (CTSF) at Fort Hood. Following the Brigade AWE and success of the CTSF concept, the DIL no longer played a major role in the digitization efforts.

The team also worked on issues associated with the integration of applique hardware onto the myriad brigade platforms and monitored the efforts of the "Installation Factory" at Fort Hood, reporting progress and delays to the senior leadership. Integration issues included early hardware reliability and electromagnetic interference testing, as well as issuing safety releases so troops could use the appliqued platforms. In addition, the team did the first risk assessment of the digitization system-of-systems that identified the tactical internet as a high-risk component. This assessment was instrumental in ensuring performance tests were conducted on the tactical internet prior to the Brigade AWE.

In the area of modeling and simulation (M&S), the Requirements and Evaluation Team focused efforts on the integration of realistic command, control, and communi-

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[11] Memorandum, OSD Director Operational Test and Evaluation, 20 September 1995, Subject: DOT&E Oversight Concept for Battlefield Digitization.

cations capabilities into the Army's analytic and training simulations. The team brought together the various factions of the M&S community to ensure that consistent representations were developed, that these representations were based on engineering realities, and that the representations were extrapolated for the level of detail needed for the application. The team was successful in integrating and leveraging the efforts underway in many pockets of the community and getting language into the Army's key M&S requirements documents to ensure command, control, and communications were an integral part of future M&S designs.

When TRADOC set up the EXFOR Coordination Cell (ECC) at Fort Hood in 1995, the team provided ADO personnel. The ECC was specifically to work cross-organizational issues associated with the Brigade AWE and the EXFOR. The ADO cell at the ECC was the on-site eyes and ears for the Army Staff, providing a weekly update of ongoing actions for the Director of the ADO, VCSA, and AAE. The cell eventually grew to four persons in an effort to cover the diverse set of activities going on at Fort Hood (from experimentation, to training, to installation, to software testing and integration).

4. Integration Team

The Integration Team focused on coordination of digitization policy and strategy. During the early years the team coordinated the Army Digitization Campaign Plan and the ADMPs. The Integration Team was also responsible for reaching out to the other Services and our allies concerning the Army's Digitization Strategy. They participated in both Joint and international forums and developed the international digitization strategy to provide a framework for coordinating and leveraging advanced and emerging technologies that would promote interoperability.

The strategy had four axes:

- Concentrate on focused bilateral efforts initially.
- Focus the Quadrilateral Army Communications and Information Systems Interoperability Group (QACISIG) to provide the formal international forum.
- Concentrate on planned multinational exercises to confirm interoperability.
- Bring results of United States-Germany and other bilateral activities to NATO through NATO Project Group 25.

There were few early successes in the Joint or international arena as the resources of the ADO were focused on getting the applique ready for the experiment. Memorandums of Agreement (MOAs) were signed in 1995 between the Army and Air

Force and Army and Navy.[12] These MOAs established coordination forums at the General Officer/Flag level as well as colonel/captain level; however, little was ever accomplished by these efforts. The Integration Team did monitor the various Joint exercises such as Joint Warfighter Integration Demonstration (JWID) and provided briefings outlining the Army's digitization strategy and program to many Joint and international meetings and symposium.

G. A SHIFT BEGINS—1996–1997

In June 1996, MG Rigby, Director of the ADO, retired from the Army. In his place came BG John Caldwell. BG Caldwell had a strong acquisition background, having been Project Manager (PM) for the M1A2 tank. Under his leadership the ADO began to look beyond the AWE scheduled for March 1997. The applique was fine for the experiment, but the Army already had warfighting platforms in the field and under development that would have to embed the software being developed (for example, the M1A2 Main Battle Tank, the M2A3 Bradley Fighting Vehicle, Apache helicopters, etc.). Moving beyond the experiment would require the Army to take a more holistic view of digitization and what it would mean to other programs—recognition that applique was not an end in itself. After the AWE in March of 1997, the Army was going to have to decide how to integrate digitization across all platforms.

In December 1996 the AAE released guidance on the implementation of embedded battle command (EBC) software.[13] The Architecture Team coordinated the guidance with DISC4; PEO Command, Control, and Communications Systems (PEO C3S, formerly PEO CCS); and the Army Systems Engineering Office (ASEO). The memorandum required all embedded weapon systems that had a requirement for situational awareness, command and control, or tactical internet connectivity to use the EBC software developed by PEO C3S. The goal was to attain interoperability between the key Force XXI weapon systems. There is still controversy associated with implementing this policy.

It was also becoming clear that the digitization of the Army was going to require a more detailed strategy than what was outlined in the ADMP. All facets of the Army staff

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12 Memorandum of Agreement, 27 July 1995, Subject: U.S. Army and U.S. Air Force Battlefield/ Battlespace Digitization Coordination, and Memorandum of Agreement, July 1995, Subject: U.S. Army, U.S. Navy and U.S. Marine Corps Battlefield/Battlespace Digitization Coordination.

13 Memorandum, ASA(RDA), 5 December 1995, Subject: Implementation Guidance on Using Embedded Battle Command (EBC) Software.

were going to have to agree on the direction and develop the programming to make it happen. There are few Army forums that bring all Army staff and major commands (MACOMs) together. The only total Army forum available was the Army Systems Acquisition Review Council (ASARC).

In November 1996, the first ADO program review ASARC, co-chaired by the VCSA and the AAE, was held. The primary purpose was to gain consensus of the council members on the strategy for fielding the first digitized division and corps XXI force. Issues included the following:

- Identification of the first digitized division and division structure,
- Fielding dates for the division and corps,
- Department of the Army Master Priority List (DAMPL) sequencing of digital equipment fielding,
- Investment decisions to go beyond equipment,
- Priority of digitization systems,
- Identification of a system integrator to organize efforts and bring systems together.

A second ASARC was held in April 1997. The purpose of the second review was to get the corporate Army in synch with the digitization process and to seek the council's guidance on methodology and resourcing. The ADO pointed out that "...there was no plan in place for programmatic execution to support the CSA's intent, since the current Program Objective Memorandum (POM) is focused on individual systems and does not take into account the digitization effort. Consequently, the Army needs to technically and operationally integrate systems, package, and synchronize them for fielding, and make resourcing decisions to support this. The need to influence both the upcoming POM update and FY00-04 POM is critical."[14]

The immediate results of the ASARCs were disappointing in that no formal decisions were made. All the issues brought forward by the ADO found little support from the Council members. The Army leadership was still focused on the upcoming AWE. The ADO received no word to cease these planning efforts, however, and for the rest of 1997 continued to develop a plan to digitize the remainder of the Army. The disciplined process required by the ADO to present this data to the ASARC gave

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[14] Memorandum, SARD-ZBA, 2 May 1997, Subject: Minutes of the Army Digitization Office (ADO) Army Systems Acquisition Review Council (ASARC) Level Program Review.

credibility to the resultant numbers and ultimately resulted in a big plus-up for digitization in the budget.

During this period the ADO Architecture Team began focusing attention on the security and vulnerability issues associated with the tactical internet. The ADO formed an assessment team with elements from the newly established Land Information Warfare Activity (LIWA), the Survivability/Lethality Analysis Directorate (SLAD), PEO C3S, 902 Military Intelligence Brigade, and others. The team developed a data collection effort during the AWE to assess the tactical internet's vulnerability. The results of this assessment were the start of a concerted effort that continues today to include information operations in all future digitization experiments and tests.

The Brigade Task Force XXI AWE was conducted in March 1997 at the National Training Center, Fort Irwin, California. ADO personnel were on site throughout the 3-week exercise. In many ways, this was an anticlimactic event from the perspective of the ADO. The ADO had already begun the work that would define its future—determining what digitizing the Army really meant. On the other hand, however, the ADO was a key player in many actions associated with post-AWE activity.

TRADOC was responsible for the conduct of the AWE and release of results. From its perspective the AWE was an unqualified success. It did indeed provide many insights into what a future digitized force could accomplish, but there were also many experimentation results that showed that it would not be a quick or easy transformation. The hypothesis for the experiment was essentially that a force equipped with new weapons and digital command and control systems would be more lethal and survivable and would fight with increased tempo than a force without these advantages. The one great success was the ability of the digital system to provide unprecedented situational awareness of blue forces to every element that had an applique. Unfortunately, the AWE was unable to convincingly prove the hypothesis. There were many reasons why the experiment was unable to meet all the goals, but perhaps the primary reason was that the units had little training time with the applique and tactical internet systems. The development and integration of software and hardware proved to be a significant challenge, so significant that the troops were never able to train fully with reliable, functional digital equipment. As a result, they could not take full advantage of the new capability and often fought as they would today. The technical system tests conducted prior to the AWE clearly demonstrated that the tactical internet would not live up to its potential. It was unable to transport messages as quickly and reliably as needed to support the warfighter.

But the pressure to meet AWE timelines resulted in inadequate hardware and software going to the AWE.

The ADO tasked OPTEC to provide a report on the performance of the applique and tactical internet during the AWE. This report painted a different picture from that of the warfighting results and created increased tensions between the ADO and TRADOC. The applique and tactical internet met neither the experimentation performance standards that were outlined in the EXMP nor the draft ORD performance requirements. As a result, the ADO tasked AMSAA to do a risk assessment of the system-of-systems to see where emphasis needed to be placed. This assessment clearly showed that development of the tactical internet was the highest risk element at the tactical level digitization system-of-systems. At the same time, DOTE published its assessment of the applique and tactical internet performance during the AWE. DOTE's analysis of the AWE data also pointed to poor system performance and the Army's inability to prove the AWE hypothesis.

These reports became the basis for developing a test and evaluation strategy to transition the applique to the Force XXI Battle Command Brigade and Below (FBCB2) program and ensure that our troops were fielded an operationally reliable and useful command and control system. The test and evaluation strategy would look at digitization as an integrated system of systems and not simply test and evaluate the FBCB2 hardware and software as a separate entity. This system of systems included FBCB2, the tactical internet, and the five Army Tactical Command and Contol Systems(ATCCS) . The many lessons learned from the AWE have been transferred to the execution of the FBCB2 test and evaluation program. There is no longer the drive to adhere to a rigid time schedule. The lack of stable performance and resultant inability of troops to train with the system recently caused OPTEC [now referred to as ATEC (Army Test and Evaluation Command)] to postpone the user test scheduled for March/April 2000.

In September 1997, in response to the ADO-sponsored AWE effort concerning digitization vulnerabilities, Congress tasked the Army to develop an assessment plan for vulnerability and update it annually. The ADO led this effort for the Army and published the *Army Vulnerability and Assessment Plan* for Congress in September 1997. The assessment concluded that there was literally no way one could guarantee total security of information systems, so the focus of the plan was on managing the risks and tradeoffs. The Army would take advantage of all testing and experiments to look at vulnerability (future AWEs, FBCB2 testing, C2 Protect ACTD), and formed the Information Systems Vulnerability and Assessment Team (ISVAT). ADO chaired the ISVAT IPT to address

technical issues, and TRADOC chaired an ISVAT Integrated Concept Team (ICT) to look at the operational issues. The IPT/ICT had several meetings and established working groups.

In February 1998, the C2 Protect function was transferred to DISC4. There have been no further reports to Congress, and the ISVAT IPT and ICT have not met. DISC4 has just recently restarted HQDA activity in the area.

H. BUILDING A PLAN TO DIGITIZE THE ARMY—1997 TO THE PRESENT

In July 1997, BG Caldwell was reassigned to the Army Material Command and was replaced by BG William Bond, an Acquisition Corps officer. Soon after the ADO arrived, the ODCSOPS announced decisions concerning the first digitized division and corps to be incorporated into The Army Plan (TAP).[15] This memorandum called for the first digitized corps by FY04. The first division (4th Infantry Division, whose brigade was the EXFOR) would be digitized by FY00. As a minimum, the list of category 1 systems identified by TRADOC would be fielded. The second division would be digitized by FY03.

1. The ADO Reorganizes

In addition to the fielding decision, the new ADO was presented with another memorandum[16] from the VCSA that would dramatically change the course of the ADO. This memorandum stated that, as a result of the ASARCs held earlier, it was clear the Army needed to consolidate and synchronize its Force XXI efforts at the Headquarters level. As such, the ADO was to be under the operational control of the Army DCSOPS as of 1 October 1997. The ADO no longer reported to the VCSA and AAE; however, the original Charter from 1994 remained unchanged.

As part of the agreement to move the ADO under the operational control of the DCSOPS, several other decisions were made. The most significant was the agreement to abide by proposed Army staff cuts and provide a plan to essentially cut the ADO positions by 50 percent by the end of FY00 and eliminate the remaining positions by the end of FY01. Since that time, several people have departed the ADO and their positions have not been filled. The cuts are made as much as possible through attrition, with personnel replaced by contractor support.

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15 Memorandum, DAMO-FDT, 1 August 1997, Subject: Army's First Digitized Division/Corps.

16 Memorandum, VCSA, 8 September 1997, Subject: Army Digitization Office Decision.

The other decision was to gradually integrate the Systems Engineering and Development Division into DISC4 because it was believed the organizations were performing overlapping functions. By transferring positions over to DISC4, this integration would also help draw the ADO down to the agreed to level. The integration experiment lasted about a year. At that time the situation was reevaluated and both sides agreed to split the functions back into the two organizations. As a result of this experiment, however, there is a much stronger relationship between the ADO and DISC4.

The move to DCSOPS created a significant shift in how the ADO operated. It was now part of the ODCSOPS bureaucracy and not functioning as an agency designed to streamline the acquisition of new technologies. An organization like ODCSOPS works through consensus, starting at the lowest management levels. The ADO up to this point worked through the highest levels. Within ODCSOPS, the ADO was placed under the Director of Force Development (DAMO–FD).

As a result of this move, the ADO also reorganized to better reflect the changing mission and functions. The four original teams were consolidated into three:

- Operations and Fielding Division (combined the Integration and Requirements and Evaluation Teams),
- Acquisition Resources Division (previously the Acquisition Team),
- Systems Engineering and Development Division (previously the Architecture Team).

Figure 3 shows the new structure and major functions.

Also at this time, the DCSOPS decided that with the ADO under his control there was no longer a need to maintain a separate Force XXI Integration Office. Several military personnel from that office were moved into the ADO. They became the nucleus of the newly formed Fielding Team. The Force XXI office also had a British foreign exchange officer attached to it. The exchange officer has been integrated into the ADO and continues to function in the fielding arena. In addition, the ADO reached out to the National Guard and Army Reserve for officers to assist in determining specific digitization requirements for this part of the force. These officers remain an integral part of the Fielding Team today.

It is important to note that as the ADO missions expanded, so did the contractor support needed to accomplish them. When the ADO began in 1994, the contract support was limited to several specialized personnel from MITRE in the Architecture Team and

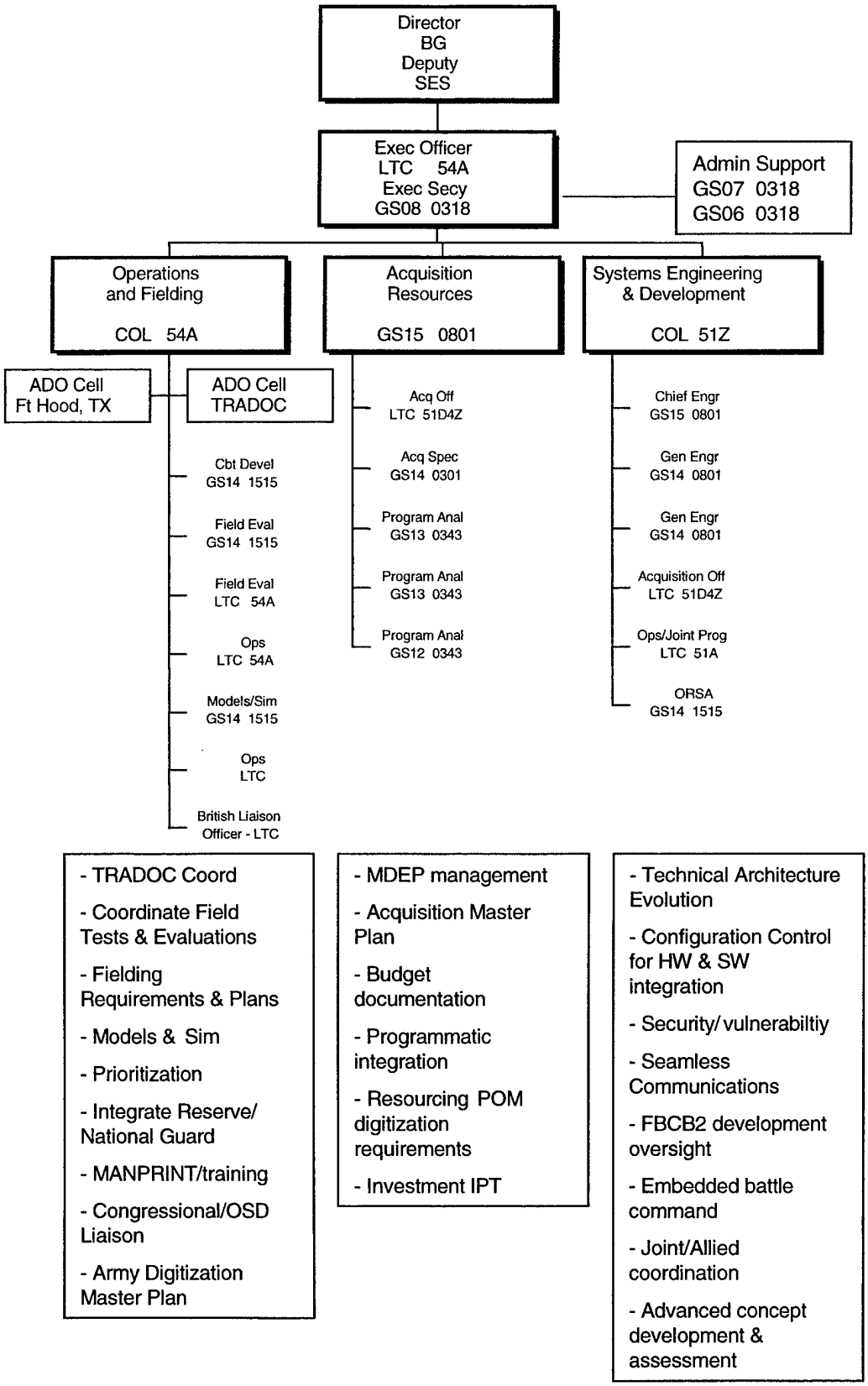

Figure 3. ADO Organizational Structure—1998

three people used to support the Integration Team with development and coordination of the ADMP and assessment of future technologies. By 1998, the contract support had grown to approximately 20 full-time personnel. That number continues to grow as the mission evolves. The ADO now has contractor support acting as liaisons at Fort Hood, Texas; TRADOC Headquarters, Fort Monroe, Virginia; and FORSCOM Headquarters, Fort McPherson, Atlanta, Georgia. As the Army and the ADO increase activities for fielding the medium brigade, the ADO has plans to place a liaison cell at Fort Lewis, Washington, as well.

2. Working Within the ODCSOPS Structure

To work within the ODSCOPS structure, the ADO had to build the necessary consensus across all the ODCSOPS organizations before any issue could be brought forward to the DCSOPS. To accomplish this, BG Bond directed a series of Integrated Process Teams (IPTs) and GOWGs be established where critical issues could be surfaced and resolved. The GOWGs were held at the one- and three-star level and dealt with such issues as:

- Role of civilian contractors on the digital battlefield,
- Digitizing the reserve component,
- Tracking soldiers with digitization skills,
- Organizational structure and soldier manning,
- Attracting and retaining skilled soldiers,
- Digital training,
- Operational testing,
- Leader development,
- Equipment retrograde plans,
- CSS enablers,
- First Digital Division reorganization.

The focus of the ADO had clearly moved to fielding a credible system-of-systems capability on the timelines outlined by the ODCSOPS August memorandum.

3. Acquisition Strategy

For the Acquisition Resources Division (ARD), this translated to the identification of issues and dollars for the upcoming POM. The ARD formed an investment

strategy IPT in 1997 to identify digitization unfunded requirements (UFRs) in preparation for the POM. These UFRs were to concentrate mainly on items directly related to fielding the hardware and software systems identified as category 1 and 2 by TRADOC. Over the next 2 years this IPT was expanded to include items in the areas of training, testing, instrumentation, post-production software support, and integration/ interoperability requirements. The IPT is now seen as a critical aspect of identifying and resolving issues associated with providing resources for the digitization strategy.

The ARD worked closely with ODCSOPS Force Development Directorate, Requirements Programming and Priorities Division (DAMO–FDR) in the cost of digitization IPT to identify which programs were part of the Army's total digitization effort. This went well beyond the TRADOC category 1 and 2 programs to include command and control, space, and intelligence systems at strategic and operational levels. The TRADOC-identified items were concentrated on the tactical and limited operational level items. The Army staff took a holistic view of the force and expanded the list to a total of 97 programs. These 97 programs were the nucleus of what became known as the Army's Digitization Strategy. The ARD tracked all 97 programs through the POM process in 1998 and 1999 and continues to do so today. The ARD makes recommendations to the DCSOPS on the priority for funding to ensure the digitization and fielding strategies can be fulfilled. The relationship between DAMO–FDR and the ARD has continued to strengthen and grow.

In 1999 the ADO was identified as the Army staff agent for resourcing and programmatics associated with executing the Army's Experimentation Campaign Plan (AECP). The AECP outlines the future AWEs and other critical events associated with reaching Force XXI. This new tasking now brings a majority of Force XXI related programming requirements under the oversight of the ADO.

In addition, the ARD and ADO are working the digitization programmatics associated with fielding the CSA's new vision for medium-weight forces. This new vision creates a challenging balancing act between the original fielding strategy for digitization approved in 1999 and the current concept. The ARD, through its IPTs, is trying to work through these competing issues for the upcoming POM.

Through the work of the ARD, the ADO continues to be the "one-stop-shop" for all budgetary and programming issues dealing with the digitization of the Army.

4. Congressional Activity

From the beginning, Congress has supported the Army's efforts to experiment with future concepts and technologies. In turn, they also scrutinized the digitization effort because they were being asked by the Army to invest heavily, up front, in experimental technologies. Digitization was going to break the 20-year acquisition program paradigm by putting technology into the hands of soldiers early on and through a series of feedback events developing the technology in a spiral, iterative process. Normal acquisition controls would be waived in an effort to streamline the process. This meant that Congress would not have the normal control or insight into how well the program was developing. Congress was also being asked to accept and fund an overall digitization strategy—the interoperability and interdependence of 97 programs with all their associated funding lines.

In 1995 the General Accounting Office, National Security and International Affairs Division, under their basic legislative responsibilities conducted a review of the Army's digitization effort.[17] The study was performed because of the importance and cost of the program, estimated by GAO at $4 billion. The report pointed out the high risk associated with the program and the lack of measurable goals associated with the experimentation that would be used to assess the value of digitization. The fallout from this report was minimal at the time, but the risks identified remain today: integration (both hardware and software), software development, hardware costs, unknown quantity requirements, communications, and interoperability with other command and control systems. Following this report, there was a limited GAO inquiry into development of the tactical internet, but to date, the GAO has not received any direct taskings from Congress to review the Army's digitization program.

The ADO was, and still is, the Army's point man for all congressional inquiries concerning digitization of the force. Early on in the life of the ADO, the focus of the effort was education, ensuring that the congressional staff understood the concept of digitization and the technologies involved. By 1997, these inquiries concentrated on budget lines and providing information on the overall digitization strategy and fielding requirements. The ADO still provides the background information and data to support testimony by the Army leadership on this portion of the Army budget.

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[17] United States General Accounting Office, "Battlefield Automation: Army's Digital Battlefield Plan Lacks Specific Measurable Goals," GAO/NSIAD-96-25, November 1995.

In June 1997 the Senate Armed Services Committee National Authorization Act directed the Army to submit a report discussing plans for fielding the first digitized division and corps. The language in the act required this report to be updated yearly. The critical piece to Congress was what portions of the Future Years Defense Program (FYDP) for fiscal year 1999 (FY99) was attributable to the fielding of the digitized division and corps. In May 1998, the ADO published the first report, entitled "Report on the Plan for Fielding the First Digitized Division and First Digitized Corps," to the Senate Armed Services Committee. This report was a comprehensive review of where the entire digitization program was at that point in time, including the AWEs, status of training, fielding, vulnerability assessments, program costs, doctrinal development, personnel issues, reserve component requirements, etc. The ADO is currently in the process of updating that report for FY00 to incorporate recent decisions, changes to the program, and new challenges that lie ahead.

5. Fielding Strategy

The Integration and Requirements/Evaluation Teams (later the Operations and Fielding Division) began fleshing out the digitization hardware requirements for the force. This effort, performed in conjunction with TRADOC and FORSCOM, was critical to determine the resource requirements. Initial focus was on the first digitized corps units identified in the August memorandum, but quickly expanded to the remainder of the force. It took over a year to gain consensus on which units would be fielded when. Hard issues dealing with fielding priorities and DAMPL changes added to the challenge. A conceptual plan was finally in place by January 1998; it was used to support resourcing during the FY99–04 mini-POM.

As the fielding plans were being developed it was clear that the Army was going to have to take a different approach than it had in the past. In an internetted force, fielding one system independently of another would no longer be feasible. The force effectiveness to be gained by having a digital force was dependent on fielding a total package of digitization systems—a system-of-systems approach. The Integration Team led the Army to a brigade-set fielding concept, where fielding would be based on organizations, not individual systems. In this concept, the brigade would be the smallest unit fielded with all the priority digital systems.

The CSA approved this concept on 18 December 1998, but it took until 16 June 1999 for release of an Army-wide memorandum announcing that the ADO would be

responsible for synchronizing the Brigade Set Fielding Concept.[18] Since that time these key documents have been signed:

- Army Digitization Master Schedule, signed by DCSOPS August 1999
- Identification of "Appropriate Corps Slice" (including the Reserve Components)
- Brigade Set Fielding Concept approved by DCSOPS July 1999, ADO appointed as system-of-systems manager
- Army Position on System Fielding Priorities for the First Digitized Division and Corps, signed by DCSOPS August 1999.

The ADO continues to refine and prepare for execution of the approved plans. At this time, the impact of the CSA's concept for the new Medium Force is being evaluated. What role the ADO will play is yet to be determined.

6. Moving the Applique into the FBCB2 Program—Evaluation and Testing

Following the AWE in March 1997, it became necessary to move the applique from an experimental piece of hardware into a mainstream development program. In July, the Army decided that the experiment was sufficient to serve as the basis of a Milestone I review which would move the program past the concept and design phase. A follow-on Milestone I/II review was held on 20 November 1997 to formally approve entry of FBCB2 into engineering and manufacturing development and determine what actions were required to manage the program through fielding.

It was during this period that the Requirements and Evaluation Team worked to identify and coordinate the documentation needed to support the milestone reviews. The ADO participated in the TRADOC ICT for the ORD and the PEO Test Integration Working Group (TIWG) to develop the TEMP. ADO personnel worked with the Army Staff, OPTEC, DOTE, TRADOC, and the PEO to develop issues, criteria, and test strategies that would ensure adoption of a system-of-systems approach.

The team served as the honest broker for Army Headquarters when it came to the analysis of the Task Force XXI AWE. In 1996 the ADO tasked OPTEC to provide a series of independent operational assessments during the early development of the applique and a final report following the AWE. During the milestone reviews these

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[18] Memorandum, DAMO-ADO (signed by the DCSOPS), 16 June 1999, Subject: Brigade Set Fielding Concept.

documents played an important role in providing the Army insights into how the applique and tactical internet performed technically and their operational impacts.

In 1997 the ADO tasked AMSAA to perform an independent analysis of the applique and tactical internet during the AWE and identify areas of risk associated with further development. The report, released in the fall of 1997, identified the tactical internet as the area of highest risk. Results of these analyses clearly showed the senior leadership that the road ahead would not be easy. As a result of this study, in 1998 the ADO tasked AMSAA, in conjunction with TRADOC and the PEO, to provide an independent look at the ability of new tactical internet concepts to meet operational performance expectations. The study was broken into several phases, the first looking at the ability of the tactical internet concept to meet the technical requirements outlined in the ORD. The next phase was to take the technical solutions, incorporate them into combat simulations, and see how well they meet the operational requirements. This study is ongoing at this writing.

After the initial development of the TEMP in 1998 and the establishment of the tactical internet studies, the ADO moved to a monitoring mode of the current test and evaluation activities for FBCB2. The FBCB2 TEMP was approved by the Army and OSD in November 1999. The ADO is also monitoring the testing of the ABCS systems, and key combat platforms like the M1A2 SEP and M2A3 Bradley, where FBCB2 embedded battle command will be evaluated. The ADO continues to work "test" and experimentation issues associated with planned AWEs.

7. Integration of MANPRINT

Another significant effort initiated by the Requirements and Evaluation Team following the AWE in 1997 was the manpower and personnel integration (MANPRINT) Overarching IPT (OIPT). MANPRINT includes six domains: manpower (the number of people required to sustain operations), personnel (identification of skill requirements), training (time and resources required to develop needed skill levels), human factors engineering (characteristics of people, ergonomics), system safety (standards), and health hazards (conditions that can cause illness or reduced job performance).

The AWE clearly showed that digitization of the force was going to create the need for different kinds of manpower, skill levels, and training needs. Yet, up until 1997, the HQDA-level organizations responsible for effecting change in these areas were not actively involved in the Force XXI digitization process.

In 1997 a new MANPRINT General Officer Steering Committee (GOSC) was established to bring MANPRINT into the forefront of system development and senior Army leaders. Mr. Hollis, DUSA-OR, and MG Ohle, ADCSPER, co-chaired the GOSC. Other members included TRADOC, ODCSOPS, Army Materiel Command (AMC), ASA Manpower and Reserve Affairs (MRA), Operational Test and Evaluation Command (OPTEC), DISC4, OTSG, and ASA (RDA).

The ADO briefed the GOSC in the summer of 1997 on the importance of and need for this system-of-systems approach, at which time the GOSC agreed to sponsor the OIPT. The ADO helped form the OIPT in an effort to have the Army address these emerging MANPRINT issues in a system-of-systems approach rather than for each individual piece of equipment. The OIPT had representatives from all the following organizations:

AMC	EPG	PERSCOM
AMEDD	FORSCOM	Signal School
ARL	Health Hazards	SLAD
Army Med Dept.	HRED	TESCO
Army Secretariat	ODCSLOG	TEXCOM
ASA (MRA)	ODCSOPS (ADO)	TPIO–ABCS
ASA (RDA)	ODCSPER (PERTECH)	TRADOC
ASC	OPTEC	USACHPPM
CASCOM	OTSG	USAFMSA
DCSINT	PEO Stamis	USATSC
DISC4	PEOC3S	

The OIPT published a MANPRINT management plan, identified key issues, and had begun efforts to address those issues. By 1999, however, the GOSC had disbanded, and the OIPT was left with no forum for implementing recommendations or discussing issues. When the GOSC ended, the ADO attempted to keep the OIPT process going, but with no senior leadership forum the OIPT also died.

At this point there is still no coordinated MANPRINT effort underway to support the digitization of the Army.

8. The Technical Challenge Continues

The Systems Engineering Division (formally the Architecture Team) continued its efforts in vulnerability and security issues, renewed emphasis on compliance with the

technical architecture, integration and interoperability of the Army Battle Command Systems (ABCS), and development of the embedded battle-command software.

9. Interoperability

To assist in defining interoperability requirements, in 1998 the ADO began a series of interoperability workshops. Each workshop concentrated on a single battlefield functional area (BFA) and did a complete review of all the systems and architectures to determine what was needed to support total interoperability. These workshops are continuing today as a means of assessing where we are and how far we need to go to attain the CSA vision of an internetted force. The Systems Engineering Division has assigned an individual to each of the BFAs to specifically track issues in this area.

Today the ADO finds itself in the role of technical "mediator" between requirements from the FBCB2 and the requirements of the receiving platform PMs. In the past, the systems engineering division dealt more with the evaluation of technologies and concepts; this new role has the division examining the technical aspects of solutions to be able to evaluate their feasibility.

The ADO is also looking to the future by sponsoring a study on C2 functionality as a follow-on to the FBCB2 system. The focus will be on the architecture of the system, ensuring functional modularity. The goal is to identify an architectural structure that can be provided to PMs developing C4I systems in the future, to ensure interoperability of software and reuse of common modules.

10. Architecture Development and Synchronization

The Army Enterprise Strategy was developed in response to the 1996 Clinger-Cohen Act that required the Services to develop an enterprise-wide information technology architecture. In December 1998, the Army Enterprise Architecture Guidance Document was published.[19] The DCSOPS was tasked to be the Enterprise synchronizer. Specifically, the ADO was to provide oversight and synchronization actions for selected deployable systems. The actions are in addition to the ongoing operational, system, and technical architecture management procedures implemented by DISC4 and TRADOC.

Following the Brigade AWE, DISC4 was given the responsibility for developing the technical and systems architectures; TRADOC, the operational architecture. The

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[19] ODISC4, *Army Enterprise Architecture Guidance Document (version 1.1)*, 23 December 1998.

DAMO–FDC division was tasked by the DCSOPS to provide oversight to operational architecture development. In 1999 the ADO replaced DAMO–FDC as the DCSOPS proponent for the operational architecture, as well as the DCSOPS representative on the Army Enterprise Architecture (AEA) Council of Colonels (CoC) and GOSC. As a voting member of these activities, the ADO placed renewed emphasis on the synchronization of the system and operational architectures. In addition, the ADO worked to ensure that AEA priorities aligned with the Army Digitization Master Strategy and that products are released in time to support the institutional processes such as the Army Modernization Plan, POM, and tables of organization and equipment (TOE) development.

ADO continues to be the primary stakeholder in development of the system architecture and was the driving force in getting DISC4 to concentrate on developing an architecture that reflected the First Digitized Division as opposed to the original DISC4 tasking of a future objective division. In addition, the ADO was able to obtain agreement between DISC4 and TRADOC to develop both the system and operational architectures at an "Enterprise" level vice the detailed information exchange requirement (IER) level that was the focus of the original design.

This refocus allowed the Army to develop a system architecture and operational architecture that could provide concrete figures to justify 1999 mini-POM requirements, and it will be used for development and justification of requirements and identification of issues in the upcoming POM. In addition, this higher level system architecture/ operational architecture is being used to link to the development of new TOE for the digitized force and the new transformation force. The two architectures have been critical for identifying the network infrastructure elements needed for each unit that are typically not BOS dependent and often therefore overlooked in TOE development.

The operational architecture, which in the past has lagged the development of the system architecture, is being refocused to an upper-level architecture design, where it is driving the development of the system architecture. This upper-level operational architecture was used as a risk-assessment tool for the system architecture design for the Joint Contingency Force AWE to be conducted in 4QFY00.

The ADO continues to push for additional uses of these now synchronized architectures, including business process reengineering for combat service support and battle command staff relationships. Under the urging of the DCSOPS, TRADOC is now in the process of chartering an ICT to look into the feasibility of such activities.

The ADO continues to participate in the Army's technical architecture migration strategy as the review and approval authority of Program Manager's Joint Technical Architecture-Army migration strategies.

11. International and Joint Interoperability

In 1996, the ADO placed renewed emphasis on the concept of international interoperability. The ADO became involved in several of the existing NATO forums and led a group of NATO officers out to view the brigade AWE. The ADO continued working issues at the policy level with DISC4, PEO C3S, and CECOM. In 1998 the Army consolidated several international efforts under the Command and Control Systems Interoperability Program (C2 SIP). The program has three main axes: ATCCIS (Army Tactical Command and Control Information System), which is development of a common data base that will "translate" message formats and data elements between NATO command systems; Multilateral Interoperability Program (MIP), which is the development of Maneuver Control System (MCS) Block IV that will be interoperable with our allies command systems through the use of (ATCCIS); and the C4I Coalition Warfare Advanced Concepts Technology Demonstration (ACTD). The ADO is funding the bulk of these activities, with limited funding from OSD and other Army Staff elements.

Today, the Army still has no coordinated effort to work Joint and international issues. The ADO volunteered to move forward in the Joint and international community because of the vacuum that existed; however, it has been unsuccessful at this point in institutionalizing these activities and getting responsible organizations like DISC4 to take control. OSD attempts at Joint and international interoperability are limited, found in ACTDs like the Extending the Littoral Battlespace ACTD that will look at a limited set of Marine Corps and Army systems.

The ADO continues to work issues in this area through sheer force of will. It has made inroads with the Marine Corps in the area of Joint interoperability and continues to work Joint technical architecture issues. By funding key international forums, the ADO has kept the Army's interests alive; however, the office is neither staffed to handle the myriad issues nor tasked to be the Army's agent for interoperability.

I. OTHER DUTIES AS ASSIGNED—Y2K OPERATIONAL EVALUATIONS

In August 1998, the Secretary of Defense determined that DoD was "making insufficient progress in its efforts to solve its Y2K problem."[20] The memorandum directed the Joint Chief of Staff (JCS) to develop an operational evaluation program. On 24 August, the Deputy Secretary of Defense expanded this to the testing of defense functional capabilities (logistics, personnel, health/medical, communications, and intelligence).[21]

On 31 August 1998 the ADO was tasked by the DCSOPS to lead a Y2K IPT with DISC4 to develop detailed plans for the Army's operational evaluations (OPEVALs) and develop support plans for the Army's role in separate Commander-in-Chief (CINC) OPEVALS and the separate OSD Functional evaluations. Primary purpose would be to deconflict plans, avoid duplication, coordinate milestones, and oversee the management of the operational evaluations. This effort, totally separate from digitization, required four people for the next 12 months and continues today as the lessons-learned portion of the DoD Y2K effort winds down.

The ADO developed the Army's Operational Order (OPORD) 99-01 Millennium Passage, signed by the DCSOPS in January 1999.[22] This OPORD laid out the mission, execution concept, and taskings for the Army's Y2K assessments. This document guided all Army OPEVAL efforts for the next year. Within the OPORD, the ADO outlined the critical mission threads to be assessed and the equipment that had to demonstrate Y2K compatibility. Each Thin Line system thus was part of an uninterrupted thread of hardware and software that together perform a task. The Thin Line systems stretched from the "sensor to shooter," or from CINC decision-makers to the units or organizations that directly conduct critical operational missions.

The ADO was the focus for all Y2K OPEVALS involving Army units and equipment. The office scheduled events, coordinated all activities, provided resources for the events, and oversaw the execution. For the Army, the ADO team managed $67.5 million dollars set aside to execute the OPEVALS. The ADO coordinated and provided resources for the units that participated, evaluation assets from OPTEC, test

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20 Memorandum, Secretary of Defense, 7 August 1998, Subject: Year 2000 Compliance.

21 Memorandum, Deputy Secretary of Defense, 24 August 1998, Subject: Year 2000 (Y2K) Verification of National Security Capabilities.

22 Memorandum, Army DCSOPS, 4 January 1999, Subject: Operation Order (OPORD) 99-01 (Millennium Passage).

assets from CECOM and PEO C3S, and other agencies that participated across the department (FORSCOM, TRADOC, DCSLOG, etc.). The ADO team also assisted in the development of critical mission threads for the Army in CINC-led OPEVALS and provided resources as required.

Y2K OPEVALS were a top priority within DoD, and the ADO participated in the Joint Staff synchronization meetings and provided updates to the senior leadership of DoD in numerous tank sessions. After the Army mission critical systems successfully go through the crossover date for leap year 2000, the ADO participation in Y2K will draw to a close. This diversion from digitization was a real success story for the ADO, which took on a high-profile task, integrated efforts across organizations that do not normally work together, and brought the Army through a "crisis" situation with no disruptions to our warfighting capability.

J. 1999–2000 CONTINUED TRANSFORMATION

In September 1998, the ADO once again saw a change in leadership. The new Commander was BG John K. Schmitt. BG Schmitt inherited an organization on its way to becoming a part of the DCSOPS "machine." Under his leadership, this relationship grew even closer. The one- and three-star GOSCs established under the previous ADO were scaled back and became forums to review the status activities, as opposed to raising new issues. Issues would now be handled through the normal DCSOPS processes. The last one-star review was held in July 1999, the last three-star review in March 1999.

With the DCSOPS relationship solidifying, the ADO was directed to develop a new charter for the organization to reflect the evolving mission. The new ADO charter was signed by the ADO director, BG Schmitt, and forwarded to the DCSOPS, DISC4, and Assistant Secretary of the Army, Research, Development and Acquisition (ASARDA) Military Deputy in April 1999. The ADO now reports to the DCSOPS–FD director and the DCSOPS, but also works closely with the DISC4 and ASARDA to accomplish the mission of synchronizing and integrating requirements, programs, force structure, and funding to ensure equipping the first digitized division by the end of FY00, the second digitized division by the end of FY03, the first digitized corps by the end of FY04, and the remainder of the force by FY10.

The Army Staff reorganization placed additional parts of the DAMO–FD under the purview of the ADO director. In 1999, the C3 and Intelligence Directorates temporarily reported to the ADO. Both directorates now report to the Director of Requirements. The Horizontal Technology Office was permanently moved into the ADO reporting

chain. In addition, the ADO placed a small liaison cell at FORSCOM Headquarters to assist in the coordination of fielding plans.

In March 1999, the ADO became part of the Army Acquisition Personnel Demonstration. Recall that the civilian spaces within the ADO belong to the AAESA. The Acquisition Personnel Demonstration is designed to improve employee development, classification, and compensation for the civilian acquisition work force and supporting personnel. The goal of the 5-year project is to enhance the quality, professionalism, and management of the Army acquisition work force through improvements in the human resources management system. The proposed project involves (1) simplified job classification, (2) broadbanding, (3) streamlined hiring processes, (4) modified application of the DoD Priority Placement Program, (5) a contribution-based compensation and appraisal system, (6) expanded training opportunities, (7) sabbaticals, (8) a voluntary emeritus program, and (9) revised reduction-in-force procedures.

As shown in Figure 4, the ADO reorganized in 1999 to better respond to the evolving missions. The newly defined roles and functions were outlined as follows:

- In accordance with Army Regulation 70-1 (Research Development and Acquisition: Army Acquisition Policy), oversee, coordinate, integrate, and synchronize requirements, programs, force structure, and funding to ensure the fielding of trained, ready, and interoperable digitized units as part of Army XXI.
- Develop and refine the ADMP using a system-of-systems approach to support TAP, Army Enterprise Architecture Master Plan, Army Modernization Plan, and Army modernization equipment fielding strategies.
- Support streamlined acquisition strategies.
- Recommend, maintain, and update planned digitization program funding throughout the program and budget cycles for the Army.
- Chair a quarterly one-star Force XXI Synchronization meeting to discuss DTLOMS matters affecting the first digitized division and corps.
- In the near term the ADO will
  - Validate operational requirements, interoperability, and technical standardization of programs and provide resources for them according to Army priorities.
  - Oversee the development of a real-time, common operating environment architecture, standards, protocols, and formats with DISC4.
  - Conduct program reviews for first digitized division and corps systems.

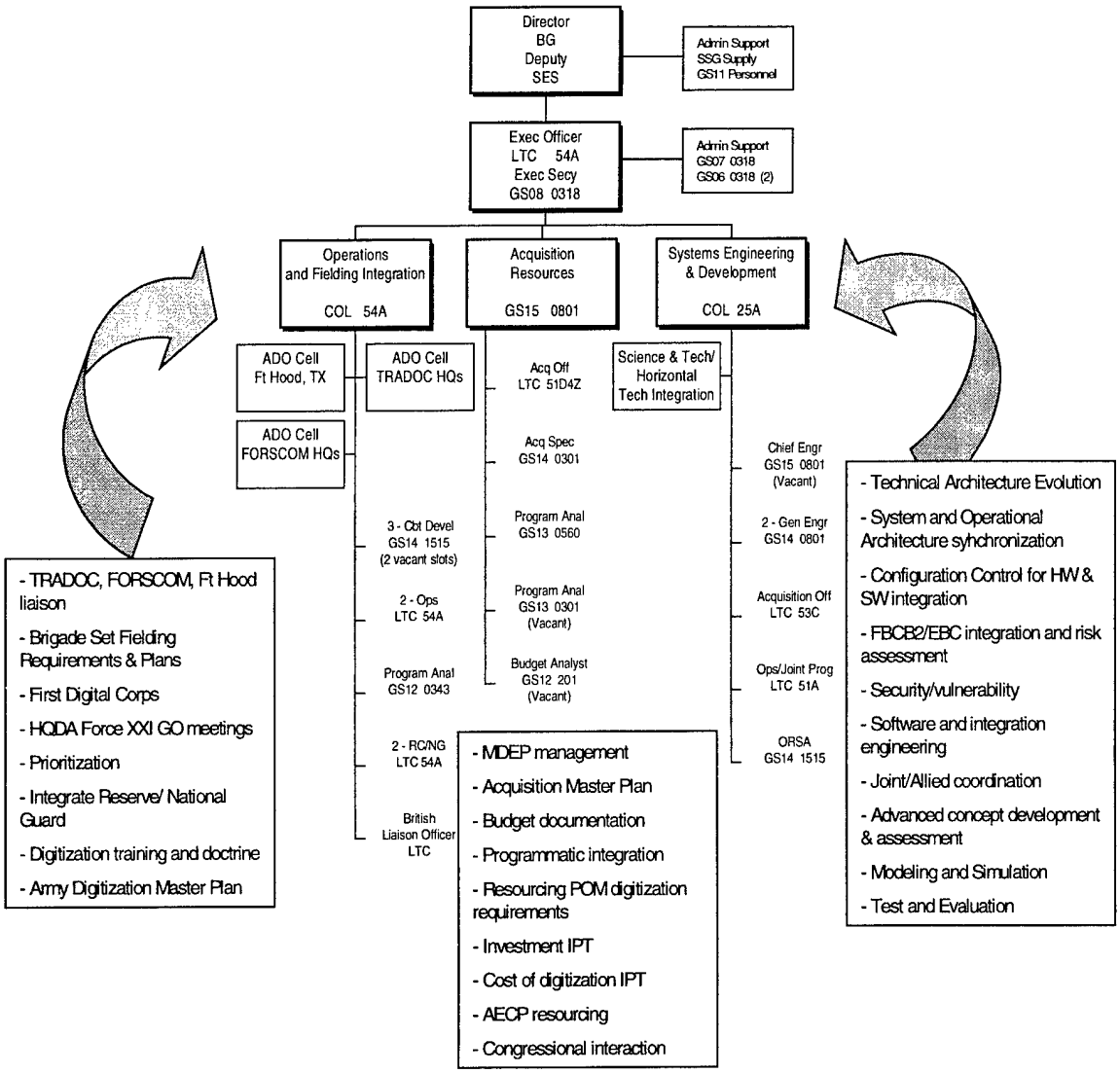

Figure 4. ADO Organizational Structure—1999

- Provide HQDA direction and staff coordination for the Army Experimentation Campaign Plan, Joint Experimentation Campaign Plan, and Joint/coalition digitization efforts.
- Develop and execute a Congressional campaign plan to support Army digitization.

With the signing of this charter, future existence of the ADO was assured. The Army had failed over the previous 5 years to institutionalize the horizontal cross-boundary functions performed by the ADO. The agreement to eliminate the ADO made in 1997 was reversed, and the ADO is funded out through the current POM (although at the previously agreed to 50-percent reduction). An organization that was formed in 1994

to get the Army through the development of a concept by working outside the system was now firmly entrenched in the system and executing the concept. It has retained its unique requirement to work horizontally across organizational boundaries. The ADO is one of the few organizations within the Army Staff that takes a holistic view—from the concept all the way to the fielding, from active duty to reserve, from Service to Joint to international, from technical challenges to training.

K. THE FUTURE...

The ADO will continue to evolve over the coming years as it begins to draw down in personnel, and the Army's focus on a medium-weight force increases. In fact, as this is being written, there are discussions of how to organize the ADO in the coming years to best support the Army transition.

The ADO was originally scheduled to cease as an organization 5 years after the initial charter was signed in 1994. Today, the challenges have moved from that of system development to fielding and integration; however, the horizontal, synchronizing nature of the mission has not changed. Because of its charter the ADO is in a unique position to cut across the bureaucracies within the Army and provide a consistent, focused, and holistic view to the challenges of manning, equipping, training, and fielding a digitized force.

GLOSSARY

AAE	Army Acquisition Executive
AAESA	Army Acquisition Executive Support Agency
ABCS	Army Battle Command Systems
ACAT III	Acquisition Category III
ACTD	Advanced Concepts Technology Demonstration
ADMP	Army Digitization Master Plan
ADO	Army Digitization Office
AEA	Army Enterprise Architecture
AECP	Army's Experimentation Campaign Plan
AMC	Army Materiel Command
AMEDD	Army Medical Department
AMSAA	Army Material Systems Analysis Activity
ARL	Army Research Laboratory
ASARC	Army Systems Acquisition Review Council
ASARDA	Assistant Secretary of the Army, Reseach, Development and Acquisition
ASC	Army Signal Command
ASEO	Army Systems Engineering Office
ATA	Army C41 Technical Architecture
ATCCIS	Army Tactical Command and Control Information System Project
ATCCS	Army Tactical Command and Control System
ATEC	Army Test and Evaluation Command
AWE	Advanced Warfighting Experiment
BFA	Battlefield functional area
BOS	battle operating system

C2 SIP	Command and Control Systems Interoperability Program
CASCOM	Combined Arms Support Command
CECOM	Communications and Electronics Command
CINC	Commander in Chief
CoC	Council of Colonels
CSA	Chief of Staff, Army
CTSF	Central Technical Support Facility
DAMO–FD	ODCSOPS Director of Force Development
DAMO–FDR	ODCSOPS Force Development Directorate, Requirements Programming and Priorities Division
DAMPL	Department of the Army Master Priority List
DCSINT	Deputy Chief of Staff, Intelligence
DIL	Digital Integration Lab
DISC4	Director, Information Systems, Command, Control, Communications and Computers
DOTE	Director, Operational Test and Evaluation
DTLOMS	Doctrine, training, leader development, organizations, material, and soldiers
EBC	Embedded battle command
ECC	EXFOR Coordination Cell
EPG	Electronic Proving Ground
EXFOR	Experimental Force
EXMP	Experimentation Master Plan
FBCB2	Force XXI Battle Command Brigade and Below
FORSCOM	Forces Command
FYDP	Future Years Defense Program
GAO	General Accounting Office
GOSC	General Officer Steering Committee
GOWG	General Officer Working Group
HQDA	Headquarters, Department of the Army
HRED	Human Research and Engineering Division
HTI	Horizontal technology integration

ICT	Integrated Concept Team
IDA	Institute for Defense Analyses
IER	Information exchange requirement
IPT	Integrated Process Team
ISVAT	Information Systems Vulnerability and Assessment Team
JCS	Joint Chiefs of Staff
JTA	Joint Technical Architecture
JWID	Joint Warfighter Integration Demonstration
LIWA	Land Information Warfare Activity
M&S	Modeling and simulation
MACOM	Major Command
MANPRINT	Manpower and personnel integration
MCS	Maneuver Control System
MDEP	Management decision package
MIP	Multilateral Interoperability Program
MNS	Mission needs statement
MOA	Memorandum of Agreement
MRA	Manpower and Reserve Affairs
ODCSPER	Office of the Deputy Chief of Staff for Personnel
ODCSLOG	Office of the Deputy Chief of Staff for Logistics
ODCSOPS	Office of the Deputy Chief of Staff for Operations
ODISC4	Office of the Director, Information Systems, Command, Control, Communications, and Computers
OIPT	Overarching Integrated Product Team
OPEVALS	operational evaluations
OPORD	Operational Order
OPTEC	Operational Test and Evaluation Command
ORD	operational requirements document
OTSG	Office of the Surgeon General

PEO C3S	Program Executive Office Command, Control, and Communications Systems
PEO CCS	Program Executive Office Command Control Systems
PERSCOM	Personnel Command
PM	Project Manager
POM	Program Objective Memorandum
PPBS	planning, programming, and budgeting system
QACISIG	Quadrilateral Army Communications and Information Systems Interoperability Group
RDA	research, development, and acquisition
SES	Senior Executive Service
SLAD	Survivability/Lethality Analysis Directorate
STF	Special Task Force
TAP	The Army Plan
TDA	Table of Distribution and Allowances
TEMP	Test and Evaluation Master Plan
TESCO	Test Equipment Services Company
TEXCOM	Test and Experimentation Command
TIWG	Test Integration Working Group
TOE	tables of organization and equipment
TPIO	TRADOC Program Integration Office
TRADOC	Training and Doctrine Command
UFR	unfunded requirement
USACHPPM	United States Army Center for Health Promotion and Preventive Medicine
USAFMSA	United States Army Force Management Support Agency
USATSC	U.S. Army Training Support Center
VCSA	Army Vice Chief of Staff

APPENDIX A

CHRONOLOGY OF EVENTS

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CHRONOLOGY OF EVENTS

1993	**November**	First Digitization Special Task Force formed
1994	**January**	Second Digitization Special Task Force formed
	May	First AWE conducted—Desert Hammer VI
	June	ADO charter signed by VCSA and AAE
	July	MG Rigby (retired), first ADO Director, arrives
	November	ASA(RDA) approves ACAT III status for Applique for experimentation
	--*	Digitization MDEP approved for POM
1995	**January**	First digitization acquisition strategy approved
	January	First Army Digitization Master Plan approved
	February	Force XXI Experimental Force (EXFOR) directive issued
	March	EXFOR coordination cell established at Fort Hood
	March	Army C4I technical architecture approved
	July	MOAs signed with the Air Force and Navy
	August	Focused Dispatch AWE
	August	Digital integration lab certification policy and procedures published
	September	DOTE digitization oversight memo signed
	November	Warrior Focus AWE

* "--" Denotes that specific date for an action/activity is not known.

1996	**March**	Army Digitization Master Plan updated and published
	June	Army technical architecture becomes basis for Joint technical architecture (JTA)
	June	VCSA declares all Army systems must be JTA compliant by 2006
	June	BG Caldwell named second Director of ADO
	November	1st Digitization ASARC convened
	December	Army publishes guidance on implementing embedded battle command software
1997	**March**	Task Force XXI AWE
	April	2nd Digitization ASARC convened
	June	DOTE briefing on AWE assessment released
	July	OPTEC report on applique/tactical internet performance during AWE published
	July	BG Bond named third Director of ADO
	July	FBCB2 Milestone I/II review held (Phase 1)
	September	Army provides congress with Vulnerability Assessment Plan
	October	ADO reporting chain changed from VCSA/AAE to DCSOPS
	November	FBCB2 Milestone I/II Phase 2 approves entry into engineering, manufacturing, and design phase of development
	--	ADO forms Army Digitization Investment Strategy IPT
	--	Digitization MANPRINT OIPT formed

1998	**January**	ADO reorganizes in response to changing mission
	February	C2 Protect function transferred to DISC4
	May	1st Digitization review sent to Senate Armed Services Committee
	August	ADO tasked by DCSOPS to lead Army Y2K OPEVALS
	September	BG Schmitt becomes fourth Director of ADO
	December	CSA approves brigade set fielding concept
	--	First interoperability workshop held
1999	**April**	New ADO charter forwarded to DCSOPS, DISC4 and ASARDA military deputy
	April	ADO reorganizes to meet tasks outlined in new charter
	July	DCSOPS names ADO system-of-systems manager for brigade set fielding
	August	DCSOPS signs Army position for digitization system fieldings
	August	DCSOPS signs Army Digitization Master Schedule (for fielding)
	November	FBCB2 test and evaluation master plan approved
	--	DCSOPS names ADO proponent for operational architecture
	--	DCSOPS names ADO as Army Staff Agent for all resourcing and programmatics for execution of Army's experimentation campaign plan

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13. ABSTRACT *(Maximum 180 words)*

This paper outlines the formation of the Army Digitization Office (ADO), its major accomplishments, and the evolution of its activities and mission. It provides insights into actions required to fundamentally change how systems are developed and fielded and the importance of having an office dedicated to that goal. In 1993, the Army set out on a path to digitize its forces. To accomplish this by 2000, the Chief of Staff of the Army realized the Army could not follow the standard processes to develop and acquire equipment. Innovative initiatives were needed. In 1993, the Special Task Force on Digitization said that a central ADO was needed to coordinate the ongoing and planned digitization activities. The ADO was formed in 1994, reporting to both the Vice Chief of Staff and the Army Acquisition Executive. Its sole focus was digitization, with a charter to cut across all Army activities involved in acquiring and fielding digital equipment. As the digitization effort matured, so has the mission of the ADO. It now reports to the Deputy Chief of Staff for Plans and Operations, but maintains a close relationship with the acquisition community.

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